PELAGIC LARVAE OF NERINIDES AGILIS (VERRILL)[1]

DAVID DEAN AND PHYLLIS A. HATFIELD

Department of Zoology and Entomology, University of Connecticut, Storrs, Conn., and the Marine Research Laboratory, Noank, Connecticut

While the authors were engaged in a study of polychaetous annelid reproduction and development, a larva similar to that of *Nerinides tridentata,* described by Hannerz (1956), began to appear in the plankton of the Mystic River estuary in June and continued to occur through August of 1962. *N. tridentata* has not been reported from the New England coast, but *N. agilis* is found in sandy beaches along the Atlantic seaboard (Verrill, 1873; Hartman, 1945; Carpenter, 1956). A three-day search of local beaches yielded but one young adult. Since ripe adults were not available for laboratory fertilization studies, development of this spionid polychaete has been described from specimens obtained from the plankton and reared in the laboratory through metamorphosis and until identification of the species was definite.

Materials and Methods

Larvae were collected in a no. 10 plankton net in qualitative tows from the Mystic River estuary, Noank, Connecticut. Larvae believed to belong to the same species, but representing various stages of development, were separated from plankton samples, described, photographed and drawn. For examination, larvae were placed on microscope slides with small pieces of Saran Wrap used as cover slips (Dean and Hatfield, 1963). This was effective in quieting the larvae without apparent injury. Photographs showing the outline of an undistorted larva and revealing a certain amount of detail were obtained using a Polaroid camera with 10-second film mounted on a phase microscope. Additional detail was provided through further photographs, descriptions and quick drawings of characteristic parts. Composite outline drawings were made from the photographs and descriptions. Following examination some of the larvae were transferred to 5-cm. funnels (Wilson, 1952) used as rearing vessels, and raised to metamorphosis. Funnels contained filtered sea water and sediment of mixed particle sizes ranging from 53 to 590 μ. Funnels were immersed in a bath of running sea water, and the larvae were fed liver powder (Howie, 1958) once a week. Sea water in the funnels was changed daily.

The sea water used was filtered through a 47 μ Millipore filter and stored in a stoppered flask immersed in the same water bath as the funnels containing the larvae. Sediment was obtained from the Mystic River estuary, washed three times with distilled water, air-dried, sieved with standard screens to obtain the particle sizes desired and stored in stoppered jars.

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OBSERVATIONS AND DISCUSSION

Pelagic larvae of *N. agilis* should be easily distinguishable from all other polychaete larvae occurring in marine plankton of the New England region. The most apparent characteristic features of all planktonic stages are the acutely pointed prostomium and the typical opaque dark-brown to black gut. The prostomium has a protrusible finger-like process at its anterior extremity which is retracted by means of two longitudinal bands of muscles. The muscles arise on the anterolateral aspects of the mouth and insert at the anterior tip of the process. The latter is usually retracted when the larvae are preserved. In the late pelagic stages, *viz.,* 14- to 16-setiger larvae, the ability to retract this organ diminishes.

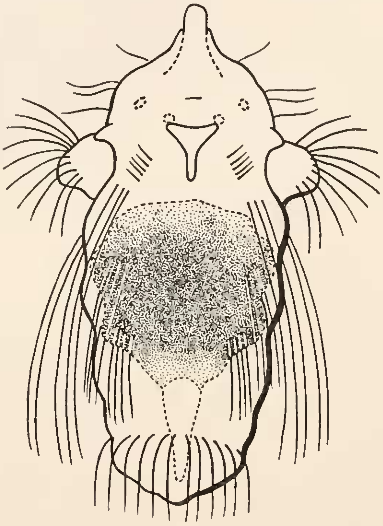

FIGURE 1. Ventral view of the 3-setiger larval stage of *Nerinides agilis.* Ciliation of the vestibule has been omitted.

Two lateral ear-like processes, called the umbrella by Häcker, as translated by Gravely (1909), are present from the 3- to 16-setiger stages and bear the prototrochal cilia. Four dark brownish-red eyes occur in almost a straight line and are present in all stages. Palp buds appear first in the 5-setiger stage and arise dorsolaterally from the umbrella. The palps grow slowly until about the 15- to 16-setiger stage, at which time their growth seems more rapid, a canal develops within them and their mobility increases.

Swimming setae occur in paired dorsal and ventral bundles on the first segment behind the umbrella, and are present up to the 16-setiger stage. At the 16- to 17-setiger stage swimming setae are lost, leaving shorter adult setae in their place. Setation on other segments consists of capillary notosetae on all segments and capillary neurosetae on setigers 1 through 11. On the twelfth setiger five hooded bidentate crotchets appear and continue on the segments posteriorly.

The mouth opens into the posterior part of the vestibule. The latter is an

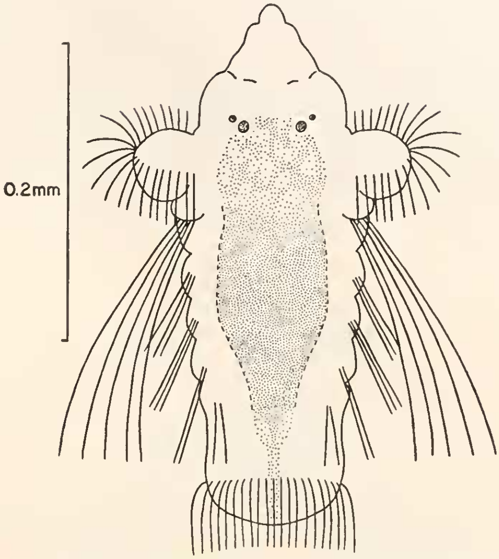

FIGURE 2. Dorsal view of the 5-setiger stage, showing palp buds posterior to the umbrella and the beginning of pharynx pigmentation. Sensory cilia have been omitted.

elongate depression on the antero-ventral aspect of the head region (Fig. 1) which is bordered posteriorly by the anterior part of the first setiger.

The pharynx appears as a large dark-brown to black pigmented area extending from the region of the peristomium posteriorly through setiger 2. The character-

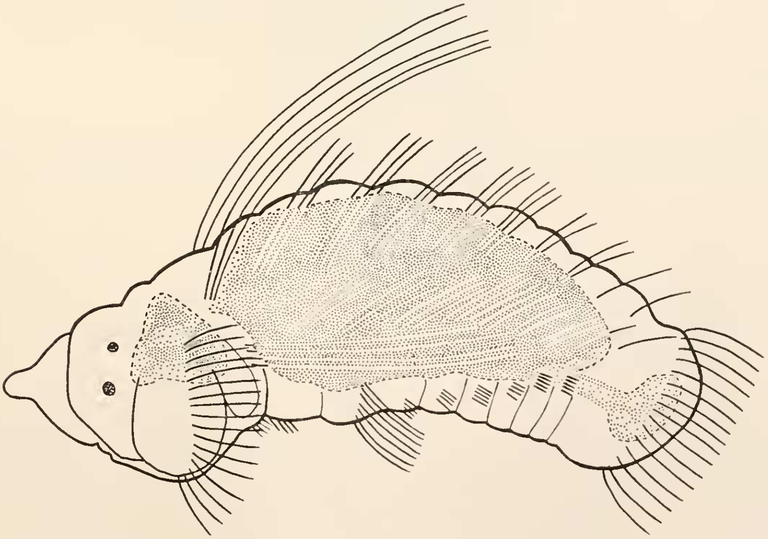

FIGURE. 3 Lateral view of the 10-setiger stage. The short cilia of the neurotroch can be seen on setigers 1 and 2. Gastrotrochs are present on setigers 3–9. Sensory cilia have been omitted.

istic reticulate pattern of the pigment of the pharynx begins to develop at the 5-setiger stage (Fig. 2). The density of pigment increases with larval development until at the 14-setiger stage it appears as dense as that of the stomach-intestine. Posteriorly from the pharynx an unpigmented oesophagus, about one segment in length, leads to the densely pigmented stomach-intestine. The latter region has lateral segmental diverticula (Fig. 4). The most posterior portion of the gut of young larvae is unpigmented (Fig. 1), while the gut in the region of the last few setigers of older larvae (Figs. 3, 4, 6) varies from partially to well pigmented. According to Hannerz (1956) the comparable region of *N. tridentata* is straight and unpigmented. In *N. agilis,* however, the gut is enlarged in the pygidial region and is pigmented (Figs. 3 and 4). In the present study the gut posterior to the last diverticula was ciliated.

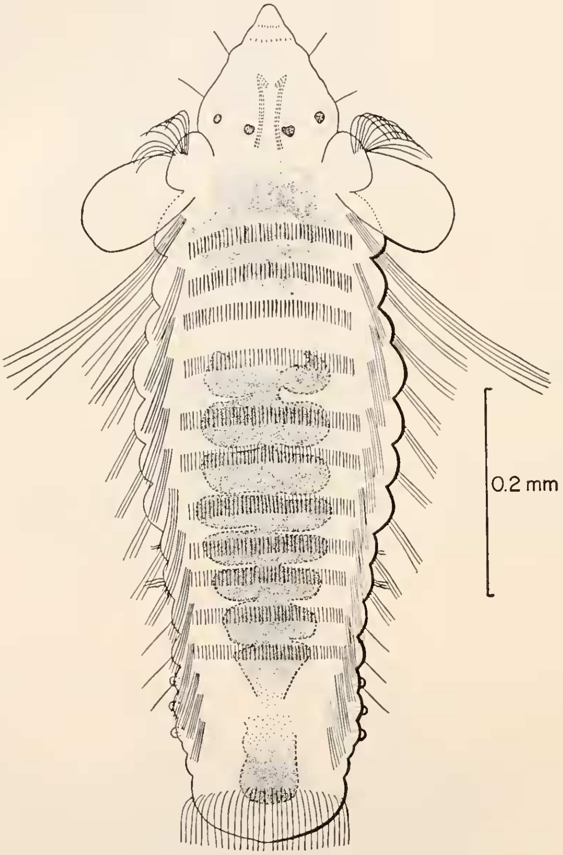

FIGURE 4. Fourteen-setiger stage in dorsal view. Nototrochs appear on setigers 1–11. Hooded crotchets appear in the neuropodia of the last three setigers.

Ciliation of *N. agilis* larvae is difficult to observe, due to the dense pigment of the gut. Cilia are of more than one type. Those of the prototroch, telotroch and the gastrotroch on setiger 3 are long and coarse. Cilia that appear on the prostomium are quite different, being variable in length, small in diameter and infrequent in movement. Wilson (1928) refers to this type as "sensory cilia." All other cilia in the larvae are short. Prototrochal cilia are discontinuous both dorsally and ventrally. The telotroch, however, consists of a completely encircling row of cilia. Gastrotrochs first appear in the 7-setiger larva and occur only on setigers 3 through 9, even in subsequent stages. There is one continuous band of cilia across the ventral surface of setiger 3. There are two patches per segment on setigers 4 through 9. The two patches are close together and near the ventral midline on setiger 4; on setigers 5 through 9 the patches become increasingly farther apart, until on setiger 9 they are lateral in position (Figs. 3 and 4).

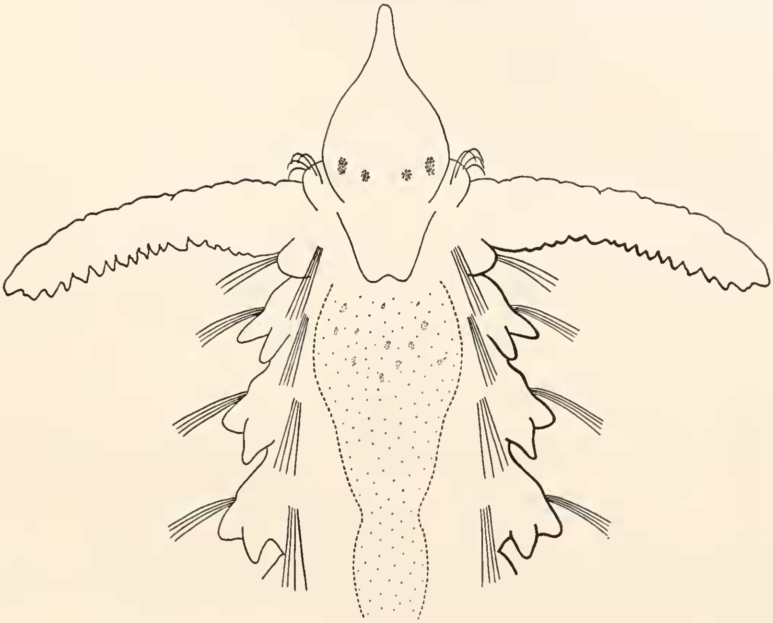

FIGURE 5. Anterior end of 17-setiger stage in dorsal view. The larva is ready to metamorphose. The larval setae of setiger 1 have been replaced by adult setae, and pharynx pigmentation is all but lost. Nototrochs and sensory cilia have been omitted.

The neurotroch (Fig. 3) makes its appearance between the 3- to 5-setiger stage. It extends from the well ciliated vestibule to setiger 2 and there ends in an inconspicuous ciliated pit.

Nototrochs were not observed in stages earlier than 14 setigers. At this stage cilia seemed to extend across the dorsal surface of segments 1 through 11 in a continuous band (Fig. 3). On 16-setiger stages examined for ciliation, nototrochs were not seen on setiger 1 but on setigers 2 through 16. In addition, these later stages showed the nototrochs to occur in three patches instead of one continuous band.

Several morphological changes take place in the larvae prior to metamorphosis.

The reticulate pigment pattern of the pharynx that is so characteristic of this larva begins to break down in the 16-setiger stage, and by the 17-setiger stage (Fig. 5) only a few dark spots smaller than the eyes remain. Adult setae are formed and accompany the swimming setae in the 16-setiger stage. The telotroch disappears and septa between the gut and body walls appear. Parapodia become more pronounced and buds of the dorsal and ventral postsetal lamellae appear. The dark pigmentation of the stomach-intestine begins to disappear progressively from the anterior toward the posterior region. Also, as the time of metamorphosis nears, the larval swimming setae are less firmly attached.

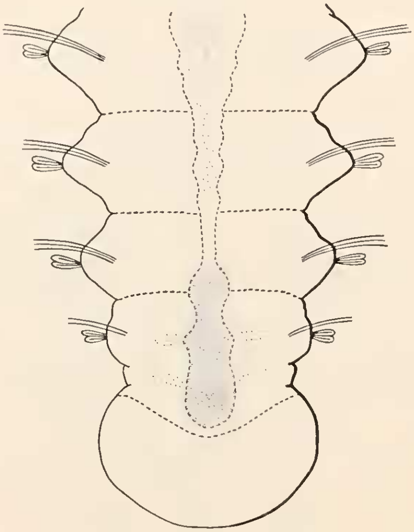

FIGURE 6. Posterior end in dorsal view of the same 17-setiger larva. Dense pigmentation of the posterior gut remains but the telotroch has been lost. Nototrochs have been omitted.

Metamorphosis occurs at the 17-setiger stage. Larvae were collected from the plankton up to but not exceeding the 17-setiger stage. The most advanced 17-setiger larvae had lost their telotrochs and larval setae, while their prototrochs, although still bearing functional cilia, were reduced to small lobes dorsal to the palpal bases (Fig. 5). All larvae reared successfully in the laboratory to benthic stages metamorphosed at the 17-setiger stage. Young benthic stages were reared to 19-setiger stages, at which time branchiae were formed on the second setiger.

Larvae reared in the laboratory were identical to larvae freshly obtained from plankton samples when specimens having the same number of segments were compared. In fact, the only variation noted during the study was a very slight difference in density of gut pigment between individuals. This was true of both reared specimens and those from the plankton.

The combination of the acutely pointed prostomium, the number and arrangement of eyes, the presence of branchiae beginning on setiger 2 and the bidentate hooded crotchets in the neuropodial segments show beyond any doubt that the larval development described is that of *Nerinides agilis*.

SUMMARY

Larvae of a spionid polychaete, occurring in the plankton of the Mystic River estuary from June through August, were isolated from plankton samples, photographed and drawn. Some of the isolated larvae were reared in the laboratory through metamorphosis and until the species was positively identified as *Nerinides agilis* (Verrill). Developmental stages of reared specimens agreed well with 3- to 17-setiger stages obtained from the plankton. Metamorphosis occurs at the 17-setiger stage. The 3-, 5-, 10-, 14- and 17-setiger stages are figured and pertinent larval characteristics described. The protrusible, acutely pointed prostomium, together with the deeply pigmented gut, are diagnostic features of all planktonic stages of this species.

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